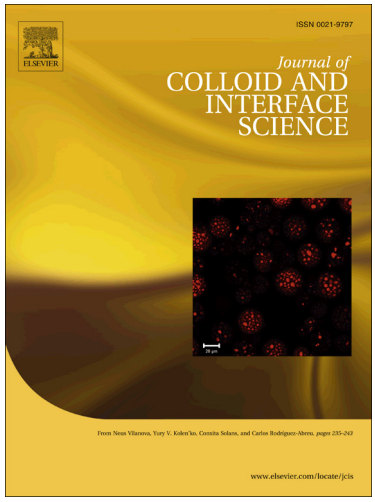

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PII: S0021-9797(17)30025-5
DOI: http://dx.doi.org/10.1016/j.jcis.2017.01.025
Reference: YJCIS 21931

To appear in: *Journal of Colloid and Interface Science*

Received Date: 11 November 2016
Revised Date: 6 January 2017
Accepted Date: 9 January 2017

Please cite this article as: S.M. Ingole, S.T. Navale, Y.H. Navale, D.K. Bandgar, F.J. Stadler, R.S. Mane, N.S. Ramgir, S.K. Gupta, D.K. Aswal, V.B. Patil, Nanostructured Tin Oxide Films: Physical Synthesis, Characterization, and Gas Sensing Properties, *Journal of Colloid and Interface Science* (2017), doi: http://dx.doi.org/10.1016/j.jcis.2017.01.025

Nanostructured Tin Oxide Films: Physical Synthesis, Characterization, and Gas Sensing Properties

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Abstract

Nanostructured tin oxide (SnO_2) films are synthesized using physical method i.e. thermal evaporation and are further characterized with X-ray diffraction, X-ray photoelectron spectroscopy, scanning electron microscopy, transmission electron microscopy, and atomic force microscopy measurement techniques for confirming its structure and morphology. The chemiresistive properties of SnO_2 films are studied towards different oxidizing and reducing gases where these films have demonstrated considerable selectivity towards oxidizing nitrogen dioxide (NO_2) gas with a maximum response of 403% to 100 ppm @200° C, and fast response and recovery times of 4 s and 210 s, respectively, than other test gases. In addition, SnO_2 films are enabling to detect as low as 1 ppm NO_2 gas concentration @200° C with 23% response enhancement. Chemiresistive performances of SnO_2 films are carried out in the range of 1-100 ppm and reported. Finally, plausible adsorption and desorption reaction mechanism of NO_2 gas molecules with SnO_2 film surface has been thoroughly discussed by means of an impedance spectroscopy analysis.

Keywords: Thermal evaporation; Tin oxide, Structure and morphology; NO_2 sensor; Impedance spectroscopy.